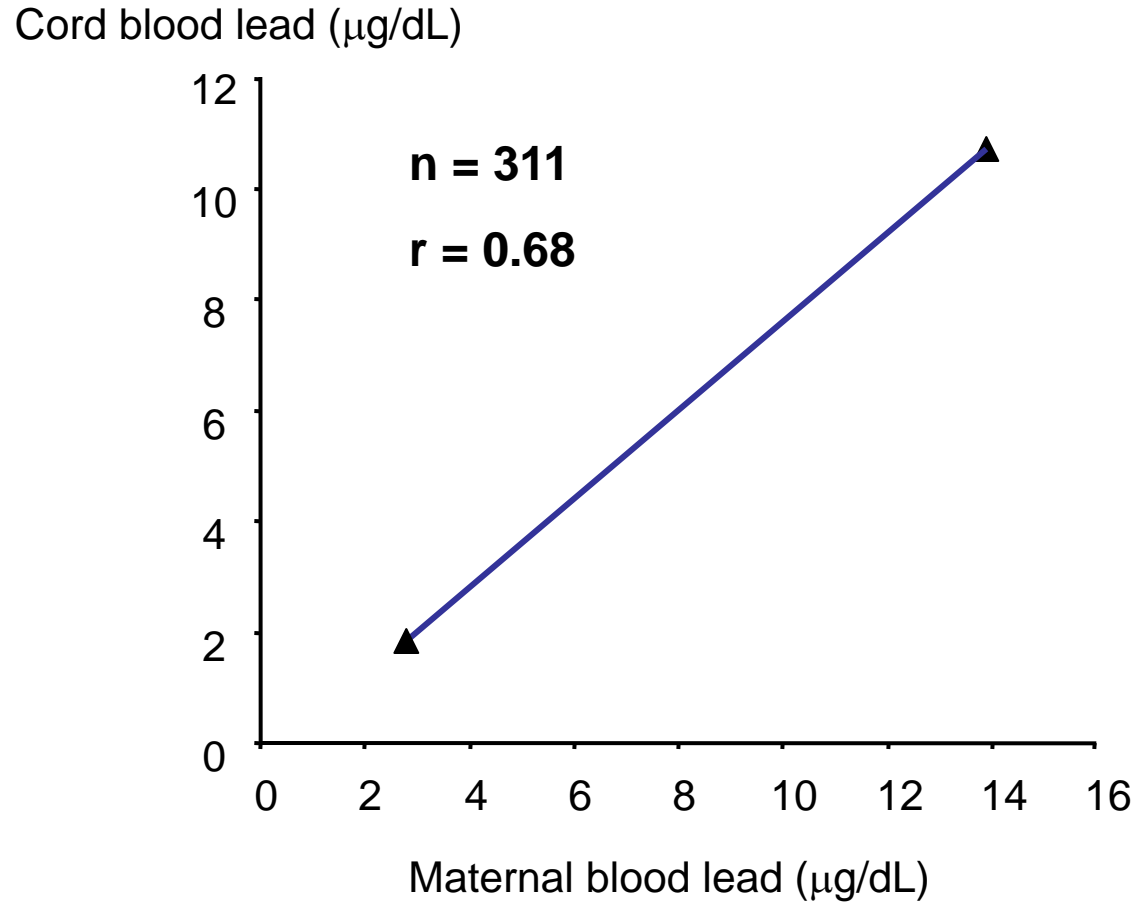


Uncovering early life metal exposures using elemental bio-imaging of teeth

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Prenatal development – a critical window

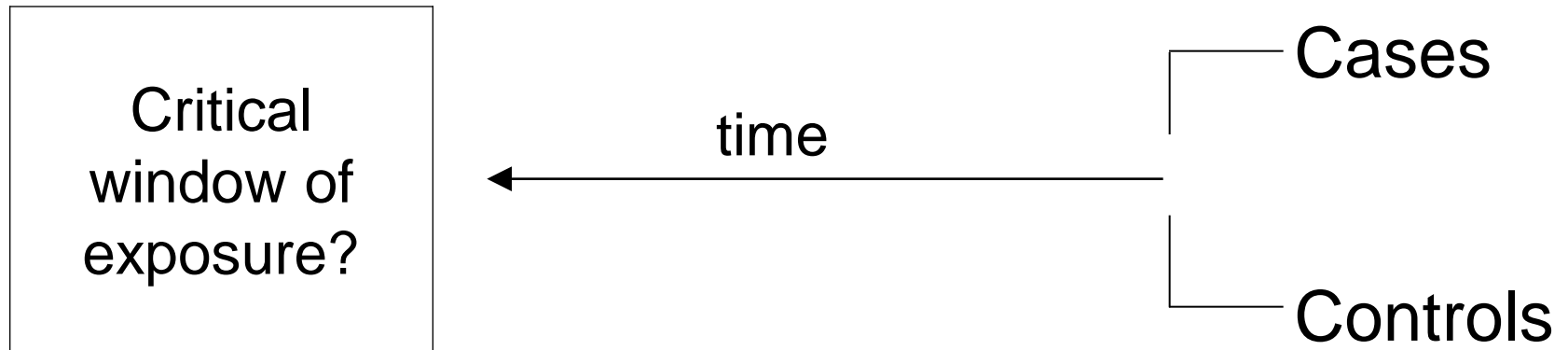


Arora et al. Unpublished data.

Difficulties in estimating prenatal exposure

- Variable partitioning across placenta
- Maternal biomarkers may not reflect fetal exposure
- Not feasible to obtain fetal tissue during pregnancy

Challenges of exposure assessment



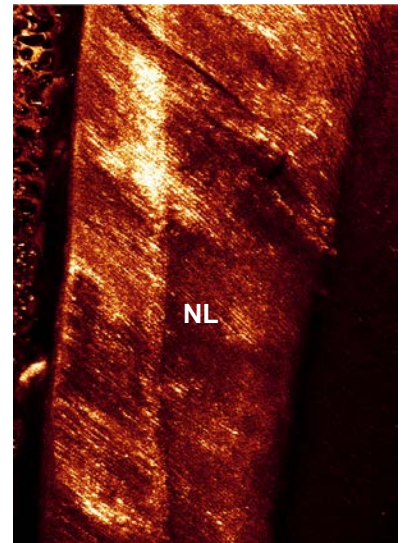
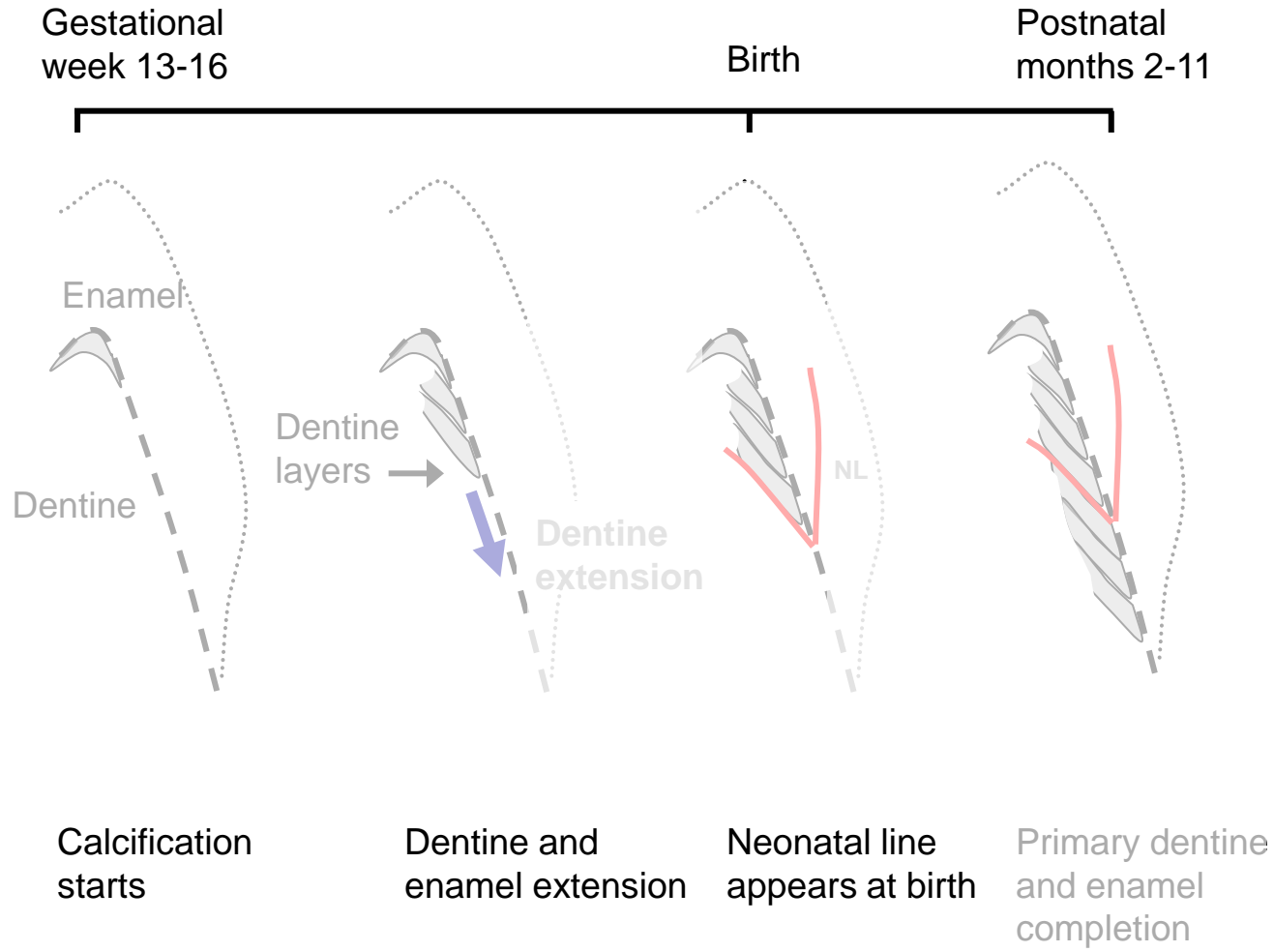
Why teeth?

- Commence development prenatally
- Non-invasive collection from 6 to 13 years of age
- Hydroxyapatite incorporates many metals

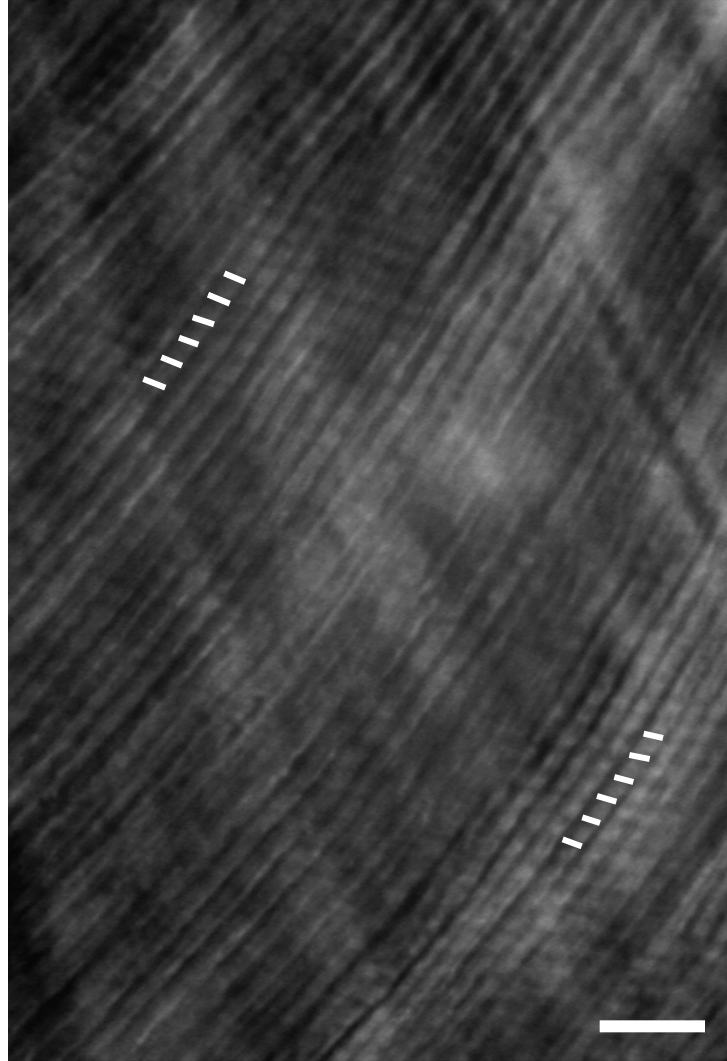
Mn – essential nutrient and toxicant

- Mn excess and deficiency linked to adverse health outcomes (Takser et al. 2003; Claus Henn et al. 2010; Zota et al. 2009)
- Perinatal development represents period of increased susceptibility
- Uncertainty over most suitable biomarker of Mn exposure (Smith et al. 2007)

Overview of tooth development



Daily growth rings in teeth

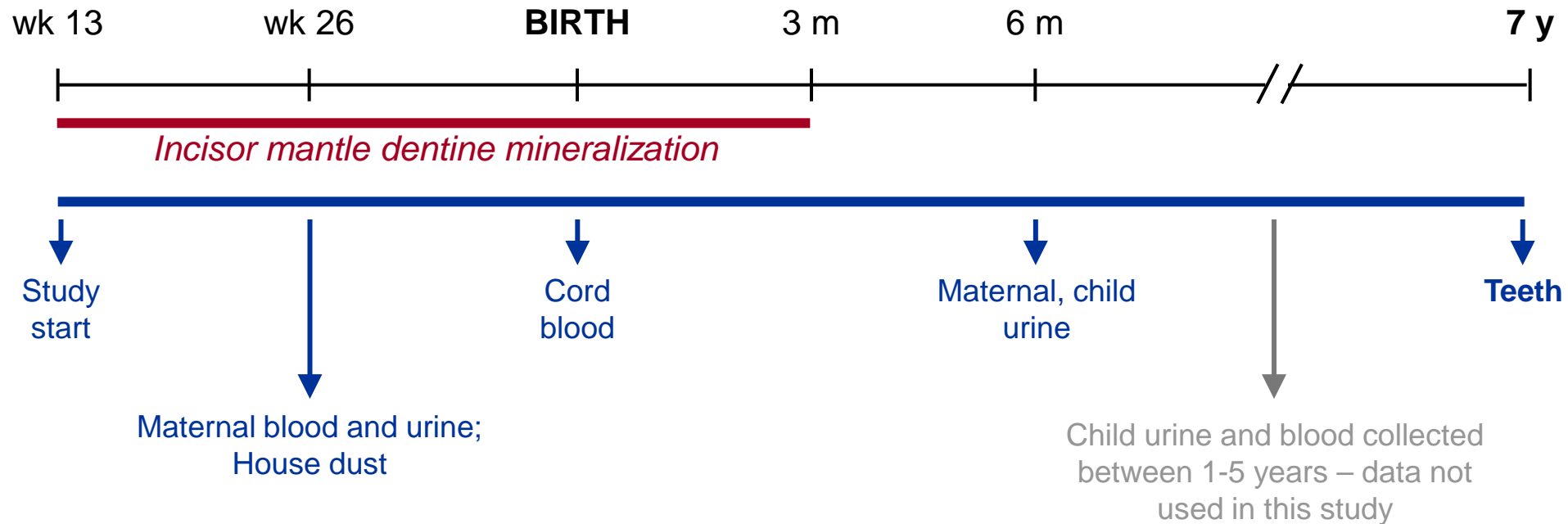


Study populations

1. CHAMACOS Study, UC-Berkeley

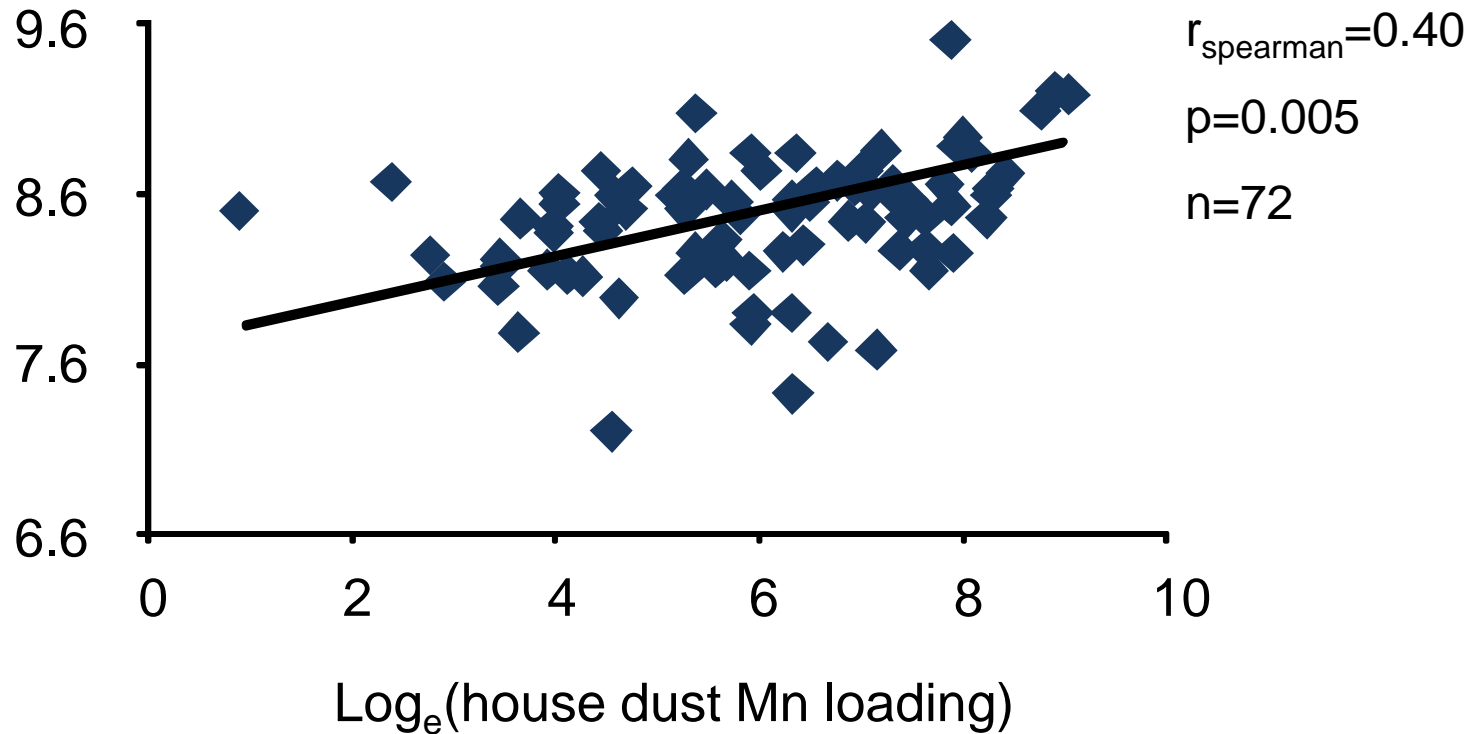
2. PHIME Study, University of Brescia , UC-Santa Cruz

CHAMACOS cohort



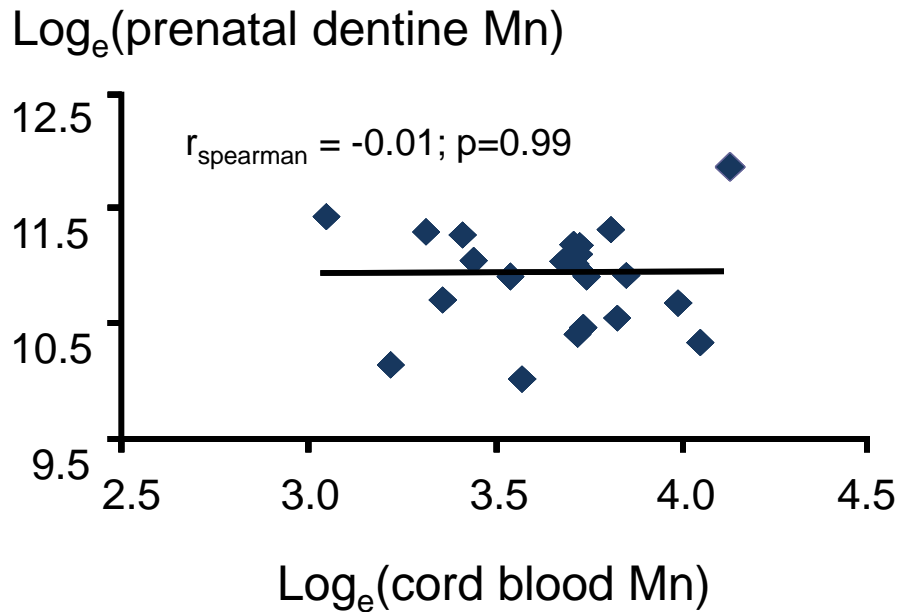
2nd trimester dentine vs house dust Mn loading

$\text{Log}_e(\text{dentine}_{2\text{nd trimester Mn}})$

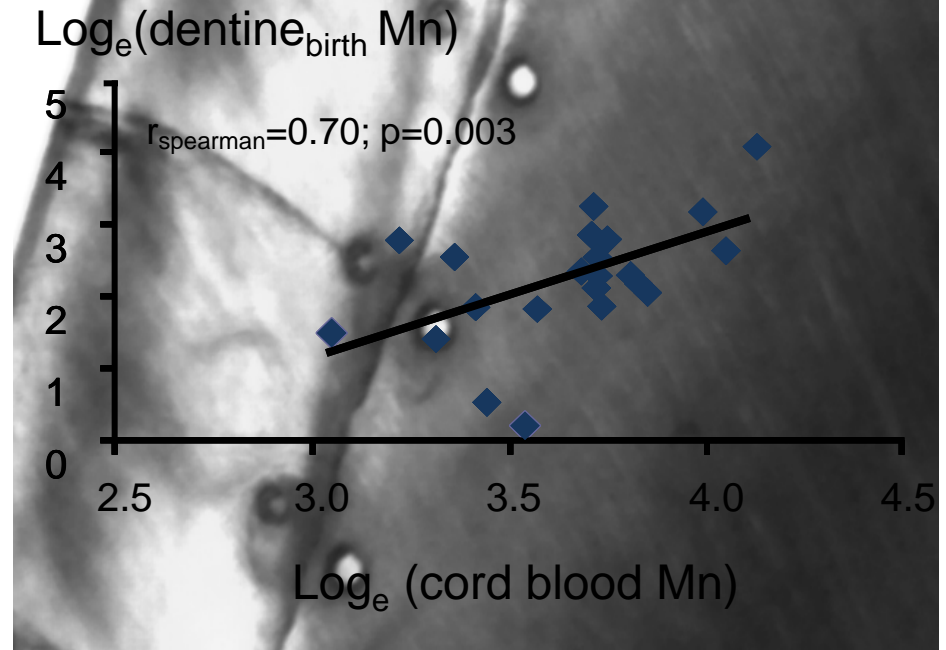


RESULTS: Cord blood Mn

All prenatal dentine

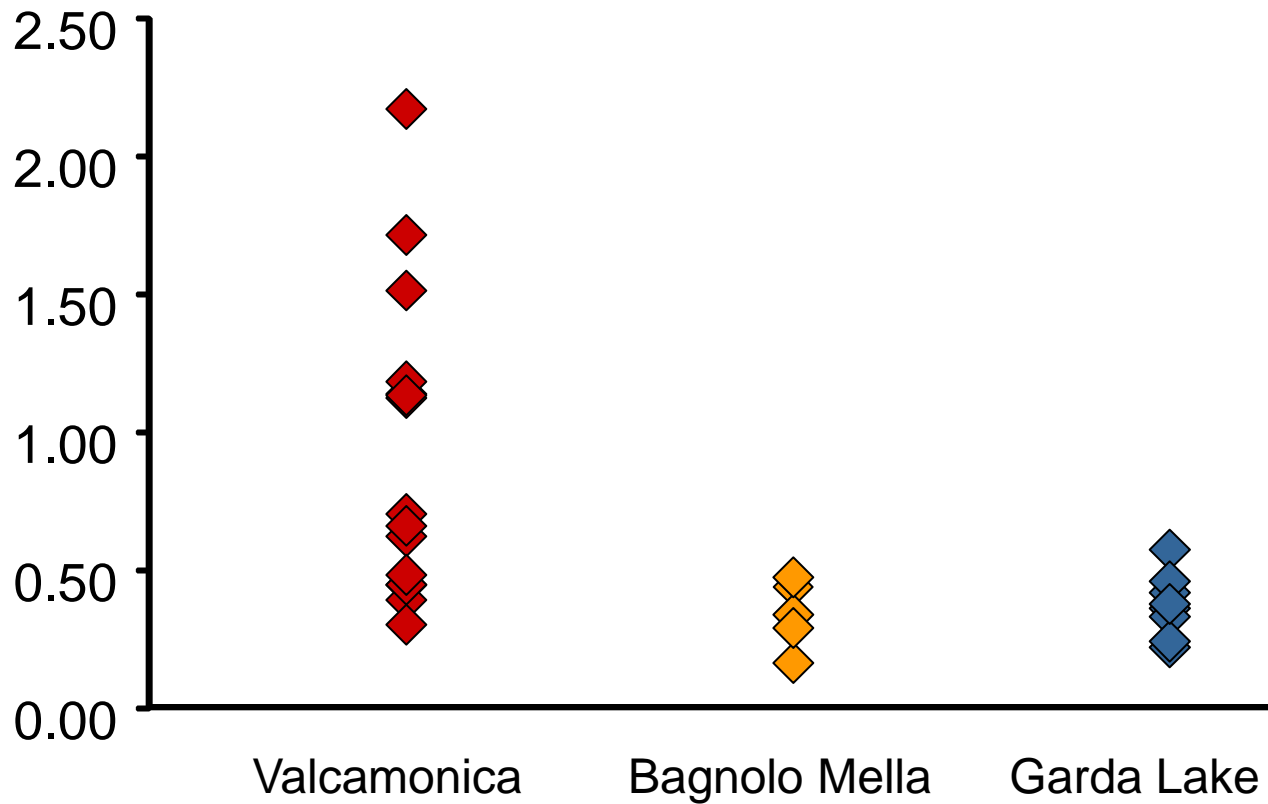


Dentine formed at birth

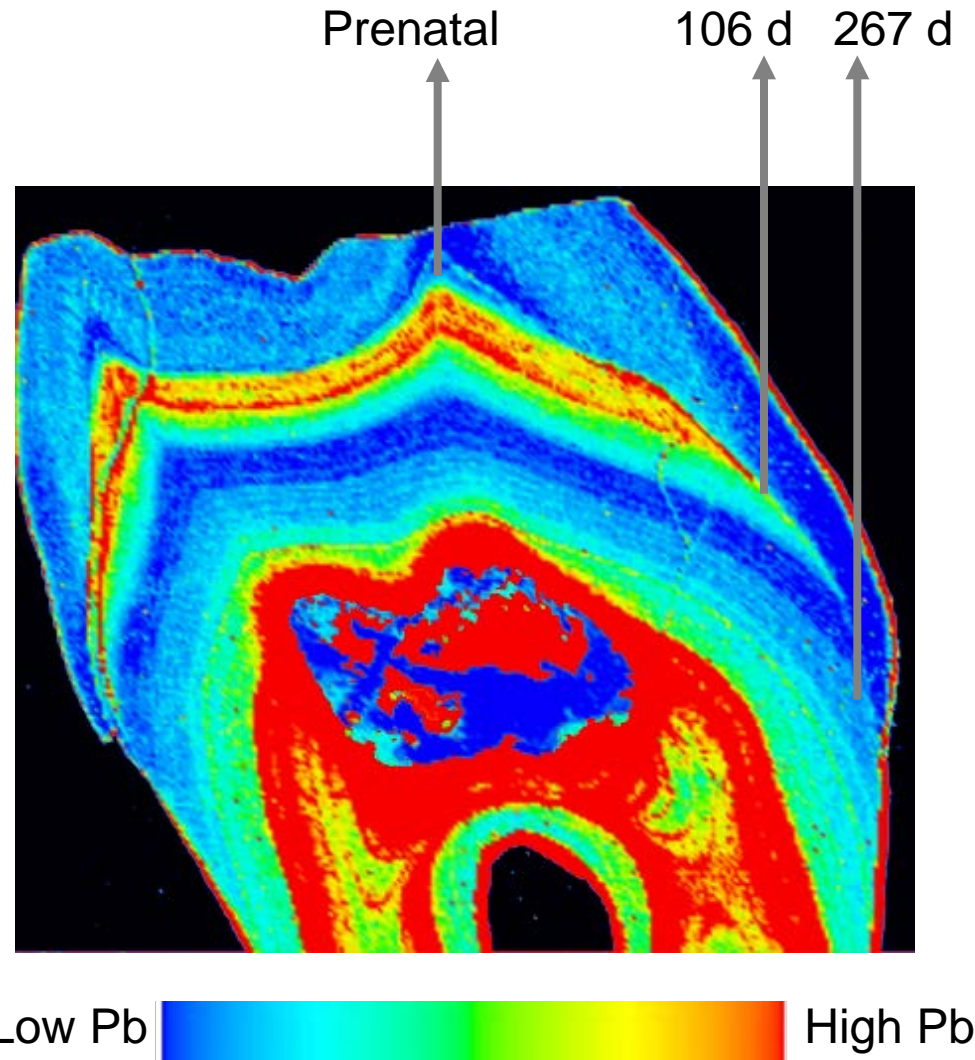


PHIME Cohort

$^{55}\text{Mn}:^{43}\text{Ca}$ AUC
prenatal dentine



Primate model of Pb exposure



Implications for environmental epidemiology

- Exposure assessment is the “Achilles Heel” of case-control studies
- Objectively reconstruct exposure during critical perinatal developmental windows *with samples collected later in life*
- Can be applied to other metals and non-metals

Future Directions - Organics

Reference	Substance
Cattaneo, C., et al.	Morphine, Codeine (forensic tox)
Pellegrini, M. et al.	Opiates and cocaine
Jan, J. et al.	Organochlorines
Jan, J. and Vrbic V.	Polychlorinated Biphenyls (PCBs)
I/S group	Nicotine, cotinine
McGrath, K.K. et al.	Drugs in bone
Camann et al.	Organics in teeth (in press)

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